



5. RESEARCH: DOE lab to explore a synthetic enzyme for use in carbon capture

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Christa Marshall, E&E reporter

Lawrence Livermore National Laboratory announced Friday that it is receiving \$3.6 million in Energy Department funding to find a cheaper, more effective way to capture and store carbon dioxide from power plants. The researchers will try a process that replicates what happens with human breathing.

Its new cash is the latest example of the department's attempt to spur technology innovation using a year-old agency that aims to do for energy what an arm of the Defense Department has done for advanced weapons and communications systems for the military.

The national lab will work with a synthetic version of an enzyme -- carbonic anhydrase -- that the human body uses to bind CO₂ quickly to blood and then expel it from the human body. Scientists are hoping that if they mimic the natural process in a lab, they can speed up the mechanism by which carbon dioxide attaches to a liquid solvent after being emitted with other gases from a power plant.

In theory, the solvent, which could include various chemical mixes, then would be heated so the CO₂ is removed for later permanent storage underneath the earth.

With the help of an enzyme, the process of capturing and storing emissions from large facilities could be sped up dramatically, said Roger Aines, carbon fuel cycle program leader at Lawrence Livermore National Laboratory. That would in turn slash the price tag on the process, because a cheaper, smaller piece of equipment could "clean" a large amount of emissions in a fraction of the time.

The challenge is that the CO₂-stripping enzyme occurring in the human body is not "survivable" in an industrial process, where bacteria and high temperatures could destroy it. So Aines and his collaborators at the University of Illinois and Babcock & Wilcox are testing man-made enzymes that are designed to survive thermal and chemical degradation.

Part of effort to commercialize a key technology

Their work attempts to overcome just one technological challenge associated with carbon capture and sequestration, or CCS, which envisions capturing CO₂ from large facilities and storing the gas underground. The technology is considered critical for the survival of coal in a carbon-constrained world but has never been proved at scale.

Coal provides almost half of U.S. electricity and spews about a third of the nation's emissions.

Dissolving CO₂ in a solvent is one way to strip it out from a stream of gases flowing from a power plant, Aines said, because other elements in a stream -- like nitrogen -- don't mix as easily in liquid.

The money for Aines' project came through the Energy Department's Advanced Research Projects Agency-Energy, or ARPA-E, which was funded initially through President Obama's 2009 stimulus package. Since then, grants like the one for Lawrence Livermore have come in spurts.

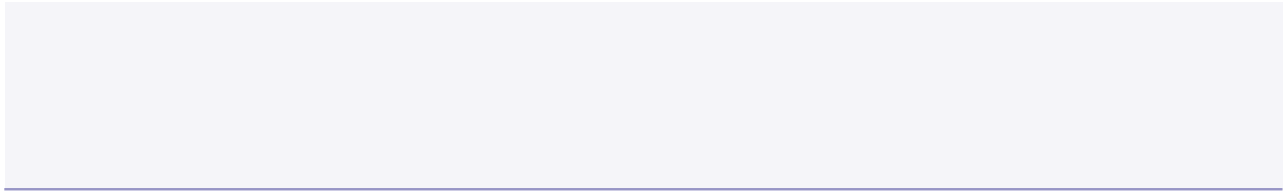
In the latest round of funding in late April, \$106 million was awarded to 37 institutions in 17 states. That came on top of \$151 million announced earlier this year by the program. An additional \$100 million was pledged in March, although specific projects for that money pot have not been selected yet.

The recipients of the \$106 million included labs studying CCS like Lawrence Livermore, along with businesses and academic centers examining biofuels and advanced batteries.

At a meeting last week of a White House task force on CCS, panelists emphasized that the technology's price tag is a huge barrier to getting it up and running ([ClimateWire](#), May 7). The task force -- set up by the Obama administration in February -- is directed with coming up with a plan to deploy five to 10 commercial CCS projects by 2016.

Ed Rubin of Carnegie Mellon University said an additional \$3 billion to \$5 billion needs to be spent on developing CCS.

The Obama administration spent \$3.4 billion in its stimulus package on the technology, and the private sector has invested some \$7 billion more. At the task force meeting, Energy Secretary Steven Chu said ARPA-E could "change the landscape" for coal, but also said the Energy Department would not have an "open purse" policy for funding projects.



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